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Original Article

Prevalence and factors associated with overactive bladder and urinary incontinence in community-dwelling Taiwanese

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ABSTRACT

Objective: To assess the prevalence of and factors associated with overactive bladder (OAB) and urinary incontinence (UI) in the Taiwanese community.
Materials and Methods: A cross-sectional design with a participant-administered questionnaire was used in 1011 adults who voluntarily visited any of the four public health centers in Pingtung County, Taiwan, for physical examinations from March to July 2010. Participants who were 40 years of age or older, who agreed to participate, and who were free of severe disabilities related to hearing, vision, speaking, and walking were included in the study. OAB was defined as "urgency" at least once a week and a total overactive bladder symptom score of three or more, while UI was defined as involuntary urine leakage at least once a week. People with an active urinary tract infection (UTI) or had a new onset of UTI symptoms (dysuria, frequency, hesitancy, flank pain) within 4 weeks prior to the study, which could interfere with lower urinary tract function, were excluded from this study.
Results: OAB was reported by 19.8% of participants ($n = 195$; women, 18.7%; men, 19.9%), while UI was reported by 19.5% ($n = 197$; women, 23.0%; men, 15.5%). OAB was significantly associated with heart disease, stroke, constipation, and UTI in the previous year. UI was significantly associated with constipation and UTI in the previous year.
Conclusions: Several chronic illnesses coexisted with OAB and UI. Healthcare providers need to be aware of an increased risk of OAB or UI among people with certain chronic illnesses, and provide appropriate healthcare.

1. Introduction

According to the 2002 standardized terminology of the International Continence Society, overactive bladder (OAB) is defined as urinary urgency, with or without urge incontinence, usually with frequency and nocturia [1]. Urinary incontinence (UI) is a complaint of any involuntary leakage of urine regardless of the volume [1]. Both symptom-defined diagnoses make these two conditions relatively easy to recognize in the community. OAB and UI are not life-threatening symptoms, but both have substantial impacts on physical, psychological, economic, and social well-being [2]. The early identification of a patient's risk factors of OAB or UI is an important step in prevention and treatment.

It is widely accepted that OAB and UI are prevalent in middle-aged and elderly people. Previous epidemiologic surveys showed the prevalence of OAB was 9.6% for those from 30 to 79 years of age (11.7% for women and 7.3% for men) in the Boston Area Community Health (BACH) survey [3]; 11.8% at the age of 18 years or older (12.8% for women and 10.8% for men) in Canada, Germany, Italy, Sweden, and the United Kingdom (A population-based and international epidemiologic studies on lower urinary tract symptom, EPIC study) [4]; and 12.4% for those 40 years of age and older (14% for men, 11% for women) in Japan [5]. The overall prevalence of weekly UI was 8.0% at the age of 30 years and older (10.4% for women and 5.3% for men) in the BACH study [3,6] and 13.1% for women and 5.4% for men 18 years of age and older in the EPIC study

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[4]; For those 40 years of age and older in Japan, weekly urge urinary incontinence (UUI) was 10% for women and 7.0% for men, while stress urinary incontinence (SUI) was 13% for women and 3% for men [7].

Several chronic illnesses associated with OAB and UI were reported in previous studies. The BACH survey reported that heart diseases were associated with OAB wet and UI, and diabetes was associated with frequency, while psychological illness was a strong predictor for all urinary symptoms [3]. In the same survey, heart disease was also associated with lower urinary tract symptoms (LUTS) as measured by the American Urological Association Symptom Index score [8]. McGrother et al [9] studied 12,570 women and found that diabetes was an independent predictor of OAB in longitudinal analysis, while OAB was significantly associated with bowel straining and SUI was significantly associated with breathlessness, asthma, and bowel straining in cross-sectional analysis. Van Gerwen et al demonstrated that diabetes, chronic obstructive pulmonary disease, and asthma in women, heart failure in men, and constipation in both genders were significantly associated with UI after adjustment for age and medical facilities [10]. Coyne et al showed that asthma, diabetes (men only), heart disease, neurologic condition, and recurrent urinary tract infection (UTI) were associated with LUTS after adjusting for age, race, and country of origin [11].

Given the diverse results of previous studies and the coexistence of chronic illnesses (e.g., diabetes, heart disease), the question of whether or not chronic illnesses contributes to or reflects OAB or UI is pertinent. So far, the answers to these questions are not fully understood. The aims of the study were to explore the occurrence of OAB and UI among middle-aged and elderly people and to investigate factors associated with OAB and UI.

2. Materials and methods

2.1. Patients

A cross-sectional study with a participant-administered questionnaire was used. A convenience sample of people who voluntarily visited any of the four public health centers in Pingtung County, Taiwan, for physical examinations were recruited from March to July 2010. The inclusion criteria were 40 years of age or older, voluntary participation, and no severe disabilities related to hearing, vision, speaking, and walking. People with an active UTI or newly onset symptoms of a UTI (dysuria, frequency, hesitancy, flank pain) within the last 4 weeks, which could interfere with lower urinary tract function, were excluded from this study.

Before the formal interviews, a 1-day training program was provided for two research assistants to ensure that they could properly explain the questionnaire via face-to-face interviews according to a standardized study protocol. The study was approved by the Meiho University Ethics Committee, and informed consent was obtained from all participants. During the interview, if any participants felt uncomfortable and wanted to discontinue the interview, they had the right to do so.

A total of 1190 participants were contacted. However, 135 participants did not complete the survey, and 44 participants who complained of an active UTI or symptoms of a UTI in the last 4 weeks were excluded. As a result, 1011 participants (539 women and 472 men) completed the survey. The sample was designed to yield results within a $\pm$3% error with 95% certainty.

2.2. Questionnaires

2.2.1. Assessment of OAB and UI

OAB was assessed using the Chinese version of the Overactive Bladder Symptom Score (OABSS), which was originally from the Japan Neurogenic Bladder Society Committee [12] and was linguistically validated [13]. The OABSS is composed of four items, i.e., urgency, frequency, nocturia, and urgency incontinence; the total score ranges from 0 to 15. OAB is defined as an OABSS of 3 or higher and an urgency score of 2 or higher (Question No. 3 of the OABSS was urgency at least once a week) [14].

UI was determined by the question, “During the past 4 weeks, how often have you experienced involuntary urine leakage?” Participants responded based on “not at all,” “less than once a week,” “once a week or more,” “about once a day,” “two–four times a day” and “five times a day or more,” with the presence of UI was defined as at least a frequency of “once a week or more.” Participants who reported UI occurred when “sneezing, coughing, doing physical activities, lifting heavy items, or with increased intra-abdominal pressure” were categorized as having SUI, while participants who reported that UI was accompanied by or immediately preceded by “a strong desire to void” were categorized as having UUI. Participants who had both SUI and UUI were defined as having mixed urinary incontinence (MUI). OAB and UI were not mutually exclusive.

2.2.2. Patient clinical and baseline characteristics

The clinical and baseline characteristics included age, sex, body mass index (BMI), employment status (yes vs. no), smoking status (current vs. previous/never), alcohol use (current vs. former/never), exercise habits (yes vs. no), and self-reported chronic illnesses, including hypertension, diabetes, heart disease (congestive heart failure, myocardial infarction, angina, coronary artery bypass, or angioplasty), hyperlipidemia, stroke, pulmonary disease (chronic obstructive pulmonary disease or asthma), gout, constipation, and UTI in the previous year. Constipation was defined as three or fewer bowel movements per week or use of laxative agents. BMI was calculated as body weight divided by height squared, and participants with a BMI of $<24\ kg/m^2$ were classified as normal weight, 24–27 kg/m^2 as overweight, and $>27\ kg/m^2$ as obese. Participants who reported exercise at least three times per week regardless of the type of exercise and duration were categorized as having regular exercise.

2.3. Statistical analysis

SPSS for Windows 17.0 (SPSS Inc, Chicago, IL, USA) was used. Data were presented as mean and standard deviation (SD) for continuous variables or number and percent (%) for categoric variables. Chi-squared tests were used to evaluate the differences in baseline variables and chronic illnesses between sexes. Furthermore, to eliminate the effects of confounders, multivariate logistic regression analysis using the enter method was used to explore the significance of factors associated with OAB and UI. The odds ratio (OR) and 95% confidence interval (CI) were calculated to evaluate the association. A p value less than 0.05 was considered statistically significant.

3. Results

3.1. Participant clinical and baseline characteristics

The characteristics of the 1011 participants completing the questionnaire are summarized in Table 1. The mean age of the participants was 61.5 ± 12.0 years (range, 40–93 years). The age distribution was similar for both women and men (60.8 ± 12.0 vs. 62.3 ± 12.0, $p = 0.068$). Women had a lower mean BMI than men (23.8 ± 3.6 vs. 24.5 ± 3.1, $p = 0.002$). The proportions of employment, smoking, and alcohol use were markedly lower in women

Table 1
Demographics and medical conditions of participants by sex.

	Total ($n = 1011$)		Women ($n = 539$)		Men ($n = 472$)		p
	n	(%)	n	(%)	n	(%)	
Age (yr)							
40–49	197	(19.5)	119	(22.1)	78	(16.5)	0.068
50–59	273	(27.0)	147	(27.3)	126	(26.7)	
60–69	241	(23.9)	128	(23.7)	114	(24.2)	
70–80	296	(29.6)	107	(19.9)	124	(26.3)	
≥ 80	68	(6.7)	38	(7.1)	30	(6.4)	
Body mass index							
<24 kg/m^2 (normal)	541	(53.5)	316	(58.6)	225	(47.7)	0.002*
24–27 kg/m^2 (overweight)	290	(28.7)	134	(24.9)	156	(33.1)	
>27 kg/m^2 (obese)	180	(17.8)	89	(16.5)	91	(19.3)	
Employment (yes)	478	(47.3)	236	(43.8)	242	(51.3)	0.017*
Smoking (current)	120	(11.9)	6	(1.1)	114	(24.2)	0.000*
Alcohol use (current)	118	(11.7)	13	(2.4)	105	(22.2)	0.000*
Exercise habit (yes)	665	(65.8)	349	(64.7)	316	(66.9)	0.462
Hypertension	304	(30.1)	153	(28.4)	151	(32.0)	0.212
Diabetes	117	(11.6)	55	(10.2)	62	(13.1)	0.145
Heart disease[a]	75	(7.4)	42	(7.8)	33	(7.0)	0.628
Hyperlipidemia	91	(9.0)	46	(8.5)	45	(9.5)	0.580
Stroke	21	(2.1)	11	(2.0)	10	(2.1)	0.931
Pulmonary disease[b]	18	(1.8)	7	(1.3)	11	(2.3)	0.216
Gout	45	(4.5)	7	(1.3)	38	(8.1)	0.000*
Constipation	193	(19.1)	108	(20.0)	85	(18.0)	0.413
UTI in the previous year	143	(14.1)	107	(19.9)	36	(7.6)	0.000*

Chi-square tests used for categorical variables.
* p value is statistically significant.
UTI = urinary tract infection.
[a] Includes congestive heart failure, myocardial infarction, angina, coronary artery bypass, or angioplasty.
[b] Includes chronic obstructive pulmonary disease or asthma.

than men (all $p < 0.001$). Hypertension was the most common comorbidity.

3.2. Prevalence of OAB and UI and potentially associated factors

The distributions of reported OAB and UI are depicted in Fig. 1. The prevalence of OAB and UI increased with age. The overall occurrence of OAB was 19.3% ($n = 195$) in this group, and it was similar in both sexes (women: 18.7% vs. men: 19.9%, $p = 0.636$; OR = 0.93; 95% CI = 0.68–1.27). About 19.5% ($n = 197$) of participants reported having problems with UI at least once per week. A significantly greater proportion of women had UI than men (23.0% vs. 15.5%, $p = 0.003$; OR = 1.63; 95% CI = 1.19–2.25). Additionally, a significantly greater proportion of women had SUI (10.6% vs. 2.1%, $p < 0.001$; OR = 5.46; 95% CI = 2.76–10.83) and mixed UI (8.3% vs. 4.9%, $p = 0.028$; OR = 1.78; 95% CI = 1.06–2.99), but they had less UUI (4.1% vs. 8.5%, $p = 0.004$; OR = 0.46; 95% CI = 0.27–0.79) than men.

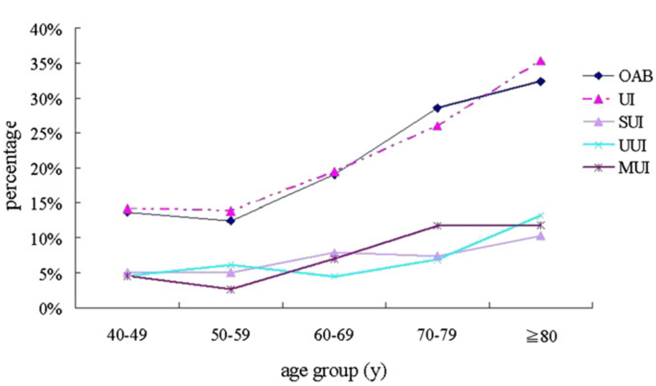

Fig. 1. Proportion of participants who reported OAB and UI according to age group. MUI = mixed urinary incontinence; OAB = overactive bladder; SUI = stress urinary incontinence; UI = urinary incontinence; UUI = urge urinary incontinence.

Multivariate logistic regression analysis showed that heart disease (OR = 2.62; 95% CI = 1.54–4.46), stroke (OR = 2.90; 95% CI = 1.10–7.63), constipation (OR = 2.55; 95% CI = 1.74–3.72), and UTI in the previous year (OR = 2.59; 95% CI = 1.68–3.97) were significantly associated with OAB. Meanwhile, constipation (OR = 2.43; 95% CI = 1.66–3.54) and UTI in the previous year (OR = 2.96; 95% CI = 1.96–4.48) were significantly associated with UI. By contrast, employment, smoking, alcohol use, regular exercise, BMI, and other chronic illnesses were not significantly statistically associated with OAB and UI (Table 2).

4. Discussion

The present study showed that 19.3% (195/1011) of participants experienced OAB, while 19.5% (197/1011) experienced UI. The rates of OAB and UI were greater in our study than in previous population-based surveys, which reported OAB prevalences of 9% to 12% [3–5] and UI prevalences of 8.0% to 13% [3,4,6]. Nonetheless, these results were not surprising because the participants in our study were recruited from public health centers, where clients are more likely to be elderly or have more chronic illnesses than those in previous population-based studies.

There is evidence indicating that the prevalence of OAB and UI increases with age [5,6]. Our study confirmed this relationship. With the fast growth of the elderly population in Taiwan, further emphases on the issues of OAB and UI are needed. Additionally, a greater proportion of women reported UI than men (23.0% vs. 15.5%, $p = 0.003$; OR = 1.63; 95% CI = 1.19–2.25), while OAB was reported by similar proportions of men and women (women: 18.7% vs. men: 19.9%; $p = 0.636$; OR = 0.93; 95% CI = 0.68–1.27). Obstetric factors such as parity or hysterectomy [15] and weaker pelvic floor muscles [16] in women may explain the higher occurrence of UI in comparison with men.

Table 2
Potential factors associated with OAB and UI in the multivariate logistical regression.

Factor	OAB (N = 195)			UI (N = 197)		
	OR	95% CI	p value	OR	95% CI	p
Age (yr)	1.03	(1.01–1.05)	0.005*	1.02	(1.00–1.04)	0.025*
Sex						
Men	1			1		
Women	0.90	(0.61–1.33)	0.607	1.50	(1.02–2.22)	0.040*
Body mass index						
<24 kg/m^2 (normal)	1				1	
24–27 kg/m^2 (overweight)	1.04	(0.70–1.56)	0.838	1.13	(0.76–1.68)	0.561
>27 kg/m^2 (obese)	1.47	(0.94–2.29)	0.091	1.24	(0.79–1.95)	0.358
Employment (yes)	0.91	(0.58–1.42)	0.673	0.86	(0.55–1.35)	0.515
Smoking (current)	1.25	(0.71–2.19)	0.435	0.83	(0.44–1.57)	0.565
Alcohol use (current)	1.56	(0.90–2.70)	0.117	1.30	(0.71–2.38)	0.397
Exercise habit (yes)	0.83	(0.58–1.19)	0.315	0.79	(0.55–1.12)	0.186
Hypertension	1.03	(0.70–1.51)	0.896	1.15	(0.78–1.70)	0.476
Diabetes	0.95	(0.58–1.58)	0.852	1.44	(0.89–2.33)	0.143
Heart disease[a]	2.62	(1.54–4.46)	0.000*	1.64	(0.94–2.84)	0.079
Hyperlipidemia	1.45	(0.83–2.53)	0.194	1.48	(0.85–2.57)	0.167
Stroke	2.90	(1.10–7.63)	0.031*	1.84	(0.69–4.89)	0.220
Pulmonary disease[b]	1.08	(0.35–3.38)	0.894	1.71	(0.57–5.10)	0.339
Gout	0.63	(0.27–1.50)	0.299	0.82	(0.34–1.96)	0.648
Constipation	2.55	(1.74–3.72)	0.000*	2.43	(1.66–3.54)	0.000*
UTI in the previous year	2.59	(1.68–3.97)	0.000*	2.96	(1.96–4.48)	0.000*

Multivariate logistical regression analysis adjusted for all variables.
*p value is statistically significant.
OAB = overactive bladder; UI = urinary incontinence; UTI = urinary tract infection.
[a] Includes congestive heart failure, myocardial infarction, angina, coronary artery bypass, or angioplasty.
[b] Includes chronic obstructive pulmonary disease or asthma.

The main purpose of this study was to explore factors associated with OAB and UI, especially in cases of chronic illness. Multivariate logistical regression showed that heart disease was significantly associated with OAB (OR = 2.62; 95% CI = 1.54–4.46), and there was a marginally statistical association of heart disease with UI (OR = 1.64; 95% CI = 0.94–2.84). This results are congruent with the study conducted by Fitzgerald et al [3], which indicated that heart disease is significantly associated with wet OAB and UI. Some proposed causes to explain this association of heart disease with OAB and UI include the use of diuretics [17], pelvic ischemia, or neurogenic denervation in ischemia disease [18]. However, the actual reason(s) between them are not completely clear, and additional studies are thus needed.

In the present study, stroke was significantly associated with OAB, which confirmed previous reports [19]. The pathophysiology of OAB involves the central neural system, including increased afferent activity, decreased capacity to process afferent information, decreased suprapontine inhibition, and increased sensitivity to contraction-mediating transmitters [20]. Following stroke, damage to the brain centers responsible for micturition can result in the inability to coordinate contraction of the bladder with relaxation of the urethral sphincter, which leads to OAB [21]. By contrast, stroke was not significantly associated with UI. The reason for this may be explained by the fact that incontinence is the result of severe neurological defects, which were not seen in this study as only ambulatory participants were recruited. As a result, stroke was not associated with UI.

Constipation was strongly associated with both OAB and UI in the present study, and this is consistent with previous reports. McGrother et al demonstrated that straining during bowel activity increased the odds of SUI and OAB in their cross-sectional analysis [9]. Coyne et al indicated that constipation was significantly associated with OAB [22]. Van Gerwen et al reported that constipation was more prevalent in people with UI compared with those without UI [10]. In addition, Charach et al reported that treating constipation could improve urinary symptoms in elderly patients [23]. Nevertheless, the possible mechanisms were not explored in depth, even though physiological reasons, such as the close anatomical proximity and similar spinal innervations between the rectum and urinary tract, were suggested to explain the associations. More studies targeting the detailed mechanism(s) are needed.

UTI in the previous year was also significantly associated with OAB and UI. Because the symptoms of current UTI mimic those of OAB and UI, we excluded current UTI as a confounder by excluding potential participants who had newly onset symptoms of a UTI (dysuria, frequency, hesitancy, flank pain) within 4 weeks prior to the study. Nonetheless, a history of UTI in the previous year remained significantly associated with OAB and UI. Litman et al also reported that previous UTIs increased the odds of LUTS [24]. Several hypotheses have been proposed to explain this result. For example, conventional UTI could lead to bladder dysfunction via inflammation, or may be a sequela of urinary problems [25]. To further prove whether inflammation during the course of a previous UTI contributes to the pathogenesis of OAB or UI, future study using laboratory tests to exclude asymptomatic UTI is needed.

Diabetes was not associated with UI or OAB in our study. This result is similar to the report by Fitzgerald et al [3]. Nonetheless, the association of diabetes with OAB and UI has been reported in other studies. In a longitudinal analysis, McGrother et al indicated diabetic women were more likely to have OAB, but not SUI [9]. After controlling for age and medical facilities, van Gerwen et al demonstrated that diabetes was significantly associated with UI in women [10]. These discrepant reports may have occurred, at least in part, because of time-dependent alterations in the bladder caused by diabetes [26]. From the standpoint of Daneshgari et al, diabetes causes the bladder to undergo two phases of alteration [26]. In the initial phase, osmotic polyuria induced by hyperglycemia causes compensatory detrusor hypertrophy and myogenic and neurogenic alterations, which subsequently lead to storage problems (e.g., OAB). As diabetes progresses, prolonged hyperglycemia and the accumulation of oxidative stress products generate decompensation of bladder tissue and function, leading to voiding problems (e.g., poor emptying or overflow incontinence) [26].

Considering both storage and voiding symptoms in the different phases of diabetic bladder dysfunction, it is easy to understand why the association with diabetes was weak in our study.

In pulmonary diseases (e.g., chronic obstructive pulmonary disease and asthma), frequent coughing is associated with SUI and UI [10] because of increased abdominal pressure transmitted to the bladder, urethra, and pelvic floor musculature. This chronic pressure weakens the competence of the bladder wall musculature and urethral sphincter, thus decreasing continence, leading to UI. In the present study, only 18 participants reported pulmonary diseases, which may be insufficient to detect a significant association between pulmonary diseases and OAB or UI.

The limitations of the present study are primarily related to its cross-sectional design and diagnoses, which were based on self-reported symptoms rather than physician diagnoses or objective tests (e.g., urodynamic and blood tests). However, we assumed that documenting the nature of OAB or UI using detailed questionnaires was sufficient. Additionally, evidence of any association needs to be carefully interpreted before a causal relationship can be claimed. Therefore, further studies designed to follow patients with chronic illnesses prospectively are needed to determine whether the progression of these chronic illnesses is still significantly associated with OAB and UI.

In conclusion, there are substantial burdens of OAB and UI in the community-dwelling population, prompting growing interest in the issues of OAB and UI. Using multivariate logistical regression controlling for all variables, the results showed that several chronic illnesses are significantly associated with OAB or UI. When treating people with OAB or UI, these associated factors that lie outside the urinary system should be considered. Also, health care providers need to be aware of an increased risk of OAB or UI among people with certain chronic illnesses.

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